

# **APPENDIX C**

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**US 7,069,224**

# US 7,069,224



**(12) United States Patent**  
Kawamura et al.

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**(45) Date of Patent:** Jun. 24, 2003

- Title: Receive for receiving audio data and audio-related information

**(54) APPARATUS AND METHOD FOR AUDIO DATA/AUDIO-RELATED INFORMATION TRANSFER**

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**(\*) Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

**(21) Appl. No.:** 09/553,590

**(22) Filed:** Apr. 20, 2000

**(30) Foreign Application Priority Data**

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Apr. 4, 2000 (JP) ..... 2000-102883

**(51) Int. Cl.:** G10L 19/00

**(52) U.S. Cl.:** 704/500, 704/501; 704/502; 704/503; 704/504

**(58) Field of Search:** 704/200, 500, 704/501, 502, 503, 504; 375/240

**(56) References Cited**  
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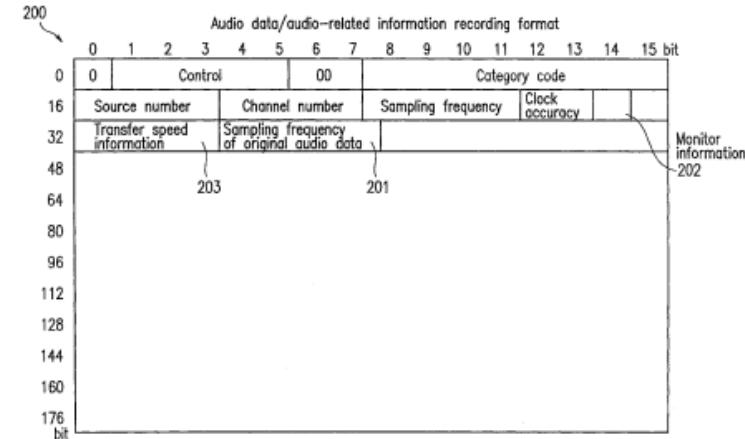
\* cited by examiner

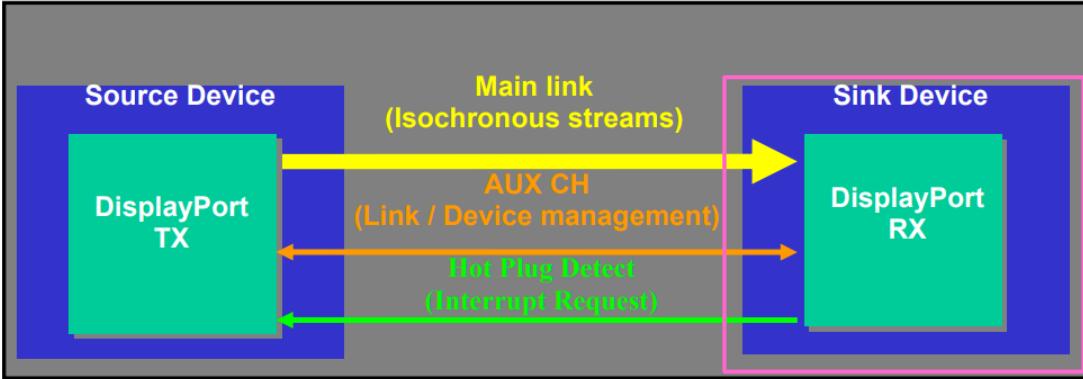
Primary Examiner—Susan McFadden  
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**(57) ABSTRACT**

A method for transferring audio data and audio-related information includes generating second audio data from first audio data, transmitting second audio data and audio-related information associated with the second audio data, and receiving the second audio data and audio-related information which includes information on a sampling frequency of the first audio data.

27 Claims, 6 Drawing Sheets



Claim 3	VESA DisplayPort Standard v1.2
<p>3. A receiver for receiving audio data and audio-related information associated with the audio data, comprising:</p>	<p><b>1.7 Overview of DisplayPort</b></p> <p>A DisplayPort link consists of a main link, an auxiliary channel (AUX CH), and a Hot Plug Detect (HPD) signal line.</p>  <p><b>Figure 1-1: DisplayPort Data Transport Channels</b></p> <p><b>2.2.5.3 <u>Audio_Stream Packet</u></b></p> <p>Transport of an audio stream is optional. When an audio stream is transported, the Audio_InfoFrame packet describing the attribute of the audio stream and Audio_TimeStamp packet must be also transported, each once per frame during the vertical blanking period of the main video stream.</p> <p><b>2.2.1.3 <u>Main Video Stream Data Packing</u></b></p> <p>The link layer must first steer pixel data in a pixel-within-lane manner as shown in Table 2-2.</p> <ul style="list-style-type: none"> <li>• <u>VB-ID</u> must carry the following information: <ul style="list-style-type: none"> <li>◦ <u>Whether to mute the audio</u></li> </ul> </li> </ul>

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Claim 3	VESA DisplayPort Standard v1.2																																																												
<p>3. A receiver for receiving audio data and audio-related information associated with the audio data, comprising:</p>	<p><b>2.2.1.5 Main Stream Attribute/Secondary-Data Packet Insertion</b></p> <p>The dummy stuffing data symbols during the video blanking periods (both vertical and horizontal) may be substituted either with main stream attributes data or a secondary-data packet. Both must be framed with SS and SE control symbols as shown in Figure 2-14.</p> <p>Lane 0 Lane 1 Lane 2 Lane 3</p> <table border="1"> <tr><td>BS</td><td>BS</td><td>BS</td><td>BS</td></tr> <tr><td>VB-ID</td><td>VB-ID</td><td>VB-ID</td><td>VB-ID</td></tr> <tr><td>Mvid7:0</td><td>Mvid7:0</td><td>Mvid7:0</td><td>Mvid7:0</td></tr> <tr><td>Maud7:0</td><td>Maud7:0</td><td>Maud7:0</td><td>Maud7:0</td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td>SS</td><td>SS</td><td>SS</td><td>SS</td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td>SE</td><td>SE</td><td>SE</td><td>SE</td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td>BE</td><td>BE</td><td>BE</td><td>BE</td></tr> <tr><td>Pix0</td><td>Pix1</td><td>Pix2</td><td>Pix3</td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </table> <p>Sea of dummy symbols</p> <p>Secondary-data Packet →</p> <p>Zero-padded bits</p> <p>First partial-pixels of Line N+1 →</p> <p>Sea of dummy symbols</p> <p>Figure 2-14: Secondary-Data Insertion</p>	BS	BS	BS	BS	VB-ID	VB-ID	VB-ID	VB-ID	Mvid7:0	Mvid7:0	Mvid7:0	Mvid7:0	Maud7:0	Maud7:0	Maud7:0	Maud7:0					SS	SS	SS	SS																	SE	SE	SE	SE					BE	BE	BE	BE	Pix0	Pix1	Pix2	Pix3				
BS	BS	BS	BS																																																										
VB-ID	VB-ID	VB-ID	VB-ID																																																										
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SS	SS	SS	SS																																																										
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BE	BE	BE	BE																																																										
Pix0	Pix1	Pix2	Pix3																																																										

Claim 3	VESA DisplayPort Standard v1.2
<p>an analysis section operable to determine whether or not the audio data is capable of being monitored by the receiver,</p>	<p><b>5.2.3.2 <i>Audio Stream Format/Timing Change</i></b> As for audio format/timing change, the Source device should set and keep VB-ID bit 4 (<u>AudioMute_Flag</u>) to a ‘1’ until after the new Audio InfoFrame and <u>Audio_TimeStamp</u> have been sent. An audio format change is caused by any of:</p> <ul style="list-style-type: none"><li>• A change between the compressed and non-compressed audio</li><li>• A change in the sampling rate</li><li>• A change in the number of channels</li></ul> <p>Those packets may be sent as soon as the next frame boundary (when the main video stream is present) or after the next 512<sup>th</sup> BS symbol set (when the main video stream is absent).</p> <p>The Sink device must mute the audio <u>when the AudioMute_Flag is set</u>, and should be ready to receive a new audio format upon detecting the change in <u>Audio InfoFrame</u> and <u>Audio_TimeStamp</u> packets.</p>

Claim 3	VESA DisplayPort Standard v1.2
<p>an analysis section operable to determine whether or not the audio data is capable of being monitored by the receiver,</p>	<p><b>6.3.1 Handling of an Audio Format Change</b></p> <p>The transported audio format may be changed at any time. The DP transmitter should start sending an audio mute signal prior to the audio format change, by setting bit 4 (AudioMute_Flag) of VB-ID which is sent once per main video stream line period (or once per 8192 link symbols when the main video stream is absent). An audio format change is caused by any of:</p> <ul style="list-style-type: none"> <li>• A change between the compressed and non-compressed audio</li> <li>• A change in the sampling rate</li> <li>• A change in the number of channels</li> </ul> <p>This signal indicates to the DP receiver that the audio system is in a transient process and the audio stream may be not valid at this time. <u>When the AudioMute Flag is ‘1’</u>, a DP receiver must disable its audio output while continuing to receive and process Audio Time-stamps.</p> <p>The DP transmitter should clear the AudioMute_Flag to ‘0’ only after finishing the transient process at the audio source input, finishing audio clock measurement with a correct and stable value and providing information about this change to the receiver. The DP transmitter should clear the audio mute signal only after transferring Audio Time-stamp and Audio Info packet (if needed).</p> <p><u>Once the DP transmitter clears the AudioMute Flag to ‘0’</u>, a DP receiver should enable its audio output only after the regenerated audio clock becomes stable and after it has collected enough audio status information.</p>

Claim 3	VESA DisplayPort Standard v1.2																								
<p>wherein the audio-related information includes monitor information indicating whether or not the audio data is capable of being monitored by the receiver, and</p>	<p><b>2.2.1.3 Main Video Stream Data Packing</b>  The link layer must first steer pixel data in a pixel-within-lane manner as shown in Table 2-2.</p> <ul style="list-style-type: none"> <li>• <u>VB-ID</u> must carry the following information: <ul style="list-style-type: none"> <li>○ Whether the main video stream is in the vertical display period or the vertical blanking period.</li> <li>○ Whether the main video stream is in the odd field or the even field for interlaced video</li> <li>○ Whether the main video stream is interlaced or non-interlaced (progressive)</li> <li>○ Whether the BS is inserted while no video stream is being transported. The symbols transmitted over the Main Link when no video stream is active are shown in Table 2-3.</li> <li>○ Whether to mute the audio</li> </ul> </li> </ul> <p style="text-align: center;"><b>Table 2-3: VB-ID Bit Definition</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center; padding: 5px;">VB-ID Bit</th> <th style="text-align: center; padding: 5px;">Bit Name</th> <th style="text-align: center; padding: 5px;">Bit Definition</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 5px;">Bit 0</td> <td style="text-align: center; padding: 5px;">VerticalBlanking_Flag</td> <td style="padding: 5px;"> <p>This bit must be set to 1 at the end of the last active line of a video frame and stay 1 during the vertical blanking period.  A Source device may clear this bit in the VB-ID either immediately prior to the first active line of a video frame (that is, the first BE of a video frame) or immediately after the first active line (that is, the first BS ending the first active line of a video frame). A Sink device must be able to handle either case.</p> <p>This bit is also set to 1 when there is no video stream (as indicated by bit 3 set to 1).</p> </td> </tr> <tr> <td style="text-align: center; padding: 5px;">Bit 1</td> <td style="text-align: center; padding: 5px;">FieldID_Flag</td> <td style="padding: 5px;"> <p>This bit must be set to:  0 right after the last active line in the top field.  1 right after the last active line of the bottom field.  Refer to 2.2.4.2 for definitions of the top and bottom fields.  For progressive (non-interlaced) video there is no bottom video and this bit remains 0.</p> </td> </tr> <tr> <td style="text-align: center; padding: 5px;">Bit 2</td> <td style="text-align: center; padding: 5px;">Interlace_Flag</td> <td style="padding: 5px;"> <p>This bit must be set to 1 when the main stream is an interlaced video.  For non-interlaced video or no video, this bit must stay 0.</p> </td> </tr> <tr> <td style="text-align: center; padding: 5px;">Bit 3</td> <td style="text-align: center; padding: 5px;">NoVideoStream_Flag</td> <td style="padding: 5px;"> <p>This bit must be set to 1 when preceding BS is inserted while no video stream is transported. When this bit = 1, the Mvid 7:0 value must be “don’t care.”</p> <p><b>Note:</b> An audio stream may be transported even when no main video stream is being transported.</p> </td> </tr> <tr> <td style="text-align: center; padding: 5px;">Bit 4</td> <td style="text-align: center; padding: 5px;">AudioMute_Flag</td> <td style="padding: 5px;"> <p>This bit must be set to 1 when the audio is to be muted.</p> </td> </tr> <tr> <td style="text-align: center; padding: 5px;">Bit 5</td> <td style="text-align: center; padding: 5px;">HDCP SYNC DETECT</td> <td style="padding: 5px;"> <p>Used by HDCP capable DisplayPort uPacket RXs to detect the CP lock status.  Refer to HDCP Specification 1.3 – Amendment for DisplayPort</p> </td> </tr> <tr> <td style="text-align: center; padding: 5px;">Bits 7:6</td> <td style="text-align: center; padding: 5px;">RESERVED</td> <td style="padding: 5px;"> RESERVED (All 0s) </td> </tr> </tbody> </table>	VB-ID Bit	Bit Name	Bit Definition	Bit 0	VerticalBlanking_Flag	<p>This bit must be set to 1 at the end of the last active line of a video frame and stay 1 during the vertical blanking period.  A Source device may clear this bit in the VB-ID either immediately prior to the first active line of a video frame (that is, the first BE of a video frame) or immediately after the first active line (that is, the first BS ending the first active line of a video frame). 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When this bit = 1, the Mvid 7:0 value must be “don’t care.”</p> <p><b>Note:</b> An audio stream may be transported even when no main video stream is being transported.</p>	Bit 4	AudioMute_Flag	<p>This bit must be set to 1 when the audio is to be muted.</p>	Bit 5	HDCP SYNC DETECT	<p>Used by HDCP capable DisplayPort uPacket RXs to detect the CP lock status.  Refer to HDCP Specification 1.3 – Amendment for DisplayPort</p>	Bits 7:6	RESERVED	RESERVED (All 0s)
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Claim 3	VESA DisplayPort Standard v1.2
<p>wherein <u>the audio-related information includes monitor information indicating whether or not the audio data is capable of being monitored by the receiver</u>, and</p>	<p><b>6.3.1 Handling of an Audio Format Change</b></p> <p>The transported audio format may be changed at any time. The DP transmitter should start sending an <u>audio mute signal prior to the audio format change, by setting bit 4 (AudioMute_Flag) of VB-ID which is sent once per main video stream line period (or once per 8192 link symbols when the main video stream is absent).</u> An audio format change is caused by any of:</p> <ul style="list-style-type: none"> <li>• A change between the compressed and non-compressed audio</li> <li>• A change in the sampling rate</li> <li>• A change in the number of channels</li> </ul> <p>This signal indicates to the DP receiver that the audio system is in a transient process and the audio stream <u>may be not valid at this time.</u> When the AudioMute_Flag is ‘1’, a DP receiver must disable its audio output while continuing to receive and process Audio Time-stamps.</p> <p>The DP transmitter should clear the AudioMute_Flag to ‘0’ only after finishing the transient process at the audio source input, finishing audio clock measurement with a correct and stable value and providing information about this change to the receiver. The DP transmitter should clear the audio mute signal only after transferring Audio Time-stamp and Audio Info packet (if needed).</p> <p>Once the DP transmitter clears the AudioMute_Flag to ‘0’, a DP receiver should enable its audio output only after the regenerated audio clock becomes stable and after it has collected enough audio status information.</p>

Claim 3	VESA DisplayPort Standard v1.2
<p>the analysis section determines whether or not the audio data is capable of being monitored by the receiver based on the monitor information.</p>	<p><b>6.3.1 Handling of an Audio Format Change</b></p> <p>The transported audio format may be changed at any time. The DP transmitter should start sending an audio mute signal prior to the audio format change, by setting bit 4 (AudioMute_Flag) of VB-ID which is sent once per main video stream line period (or once per 8192 link symbols when the main video stream is absent). An audio format change is caused by any of:</p> <ul style="list-style-type: none"><li>• A change between the compressed and non-compressed audio</li><li>• A change in the sampling rate</li><li>• A change in the number of channels</li></ul> <p>This signal indicates to the DP receiver that the audio system is in a transient process and the audio stream may be not valid at this time. <u>When the AudioMute_Flag is '1'</u>, a DP receiver must disable its audio output while continuing to receive and process Audio Time-stamps.</p> <p>The DP transmitter should clear the AudioMute_Flag to '0' only after finishing the transient process at the audio source input, finishing audio clock measurement with a correct and stable value and providing information about this change to the receiver. The DP transmitter should clear the audio mute signal only after transferring Audio Time-stamp and Audio Info packet (if needed).</p> <p>Once the DP transmitter clears the <u>AudioMute_Flag to '0'</u>, a DP receiver should enable its audio output only after the regenerated audio clock becomes stable and after it has collected enough audio status information.</p>

Claim 5	VESA DisplayPort Standard v1.2
5. A receiver according to claim 3, wherein <u>the audio data is muted if the monitor information indicates that the audio data is not capable of being monitored by the receiver.</u>	<p><b>5.2.3.2 Audio Stream Format/Timing Change</b></p> <p>As for audio format/timing change, the Source device should set and keep <u>VB-ID bit 4 (AudioMute Flag)</u> to a '<u>1</u>' until after the new Audio InfoFrame and Audio_TimeStamp have been sent. An audio format change is caused by any of:</p> <ul style="list-style-type: none"><li>• A change between the compressed and non-compressed audio</li><li>• A change in the sampling rate</li><li>• A change in the number of channels</li></ul> <p>Those packets may be sent as soon as the next frame boundary (when the main video stream is present) or after the next 512<sup>th</sup> BS symbol set (when the main video stream is absent).</p> <p><u>The Sink device must mute the audio when the AudioMute Flag is set, and should be ready to receive a new audio format upon detecting the change in Audio InfoFrame and Audio_TimeStamp packets.</u></p>

Claim 5	VESA DisplayPort Standard v1.2
5. A receiver according to claim 3, wherein <u>the audio data is muted if the monitor information indicates that the audio data is not capable of being monitored by the receiver.</u>	<p><b>6.3.1 Handling of an Audio Format Change</b></p> <p>The transported audio format may be changed at any time. The DP transmitter should start sending an <u>audio mute signal prior to the audio format change, by setting bit 4 (AudioMute_Flag) of VB-ID which is sent once per main video stream line period (or once per 8192 link symbols when the main video stream is absent).</u> An audio format change is caused by any of:</p> <ul style="list-style-type: none"><li>• A change between the compressed and non-compressed audio</li><li>• A change in the sampling rate</li><li>• A change in the number of channels</li></ul> <p>This signal indicates to the DP receiver that the audio system is in a transient process and <u>the audio stream may be not valid at this time. When the AudioMute Flag is '1', a DP receiver must disable its audio output while continuing to receive and process Audio Time-stamps.</u></p> <p>The DP transmitter should clear the AudioMute_Flag to '0' only after finishing the transient process at the audio source input, finishing audio clock measurement with a correct and stable value and providing information about this change to the receiver. The DP transmitter should clear the audio mute signal only after transferring Audio Time-stamp and Audio Info packet (if needed).</p> <p>Once the DP transmitter clears the AudioMute_Flag to '0', a DP receiver should enable its audio output only after the regenerated audio clock becomes stable and after it has collected enough audio status information.</p>